



Missouri Department of Natural Resources

Biological Assessment Report

**Mine a Breton Creek
Washington County, Missouri**

Fall 2011 – Spring 2012

Prepared for:
Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

Prepared by:
Missouri Department of Natural Resources
Division of Environmental Quality
Environmental Services Program
Water Quality Monitoring Section

Table of Contents

Section		Page
1.0	Introduction.....	1
1.1	Purpose.....	1
1.2	Tasks	1
1.3	Null Hypotheses.....	1
2.0	Methods.....	1
2.1	Station Descriptions	2
2.1.1	Land Use Description	4
2.2	Stream Habitat Assessment Project Procedure	5
2.3	Bioassessment	6
2.3.1	Macroinvertebrate Sampling and Analyses	6
2.3.2	Physicochemical Water Sampling and Analyses.....	6
2.3.3	Fine Sediment Dissolved Metals Characterization	7
2.3.4	Discharge	7
3.0	Results and Analyses	7
3.1	Land Use	7
3.2	Stream Habitat Assessment.....	8
3.3	Biological Assessment and Macroinvertebrate Community Analyses....	9
3.4	Physicochemical Water Parameters.....	12
3.5	Fine Sediment Dissolved Metals Parameters.....	14
4.0	Discussion.....	15
5.0	Conclusion	17
6.0	Literature Cited	19

Tables

	Page	
Table 1	Descriptive Information for the Mine a Breton Creek Stations.....	2
Table 2	Percent Land Use in the Mine a Breton Creek Stations and Ozark/Meramec Ecological Drainage Unit.....	4
Table 3	Stream Habitat Assessment Scores and Percentage Comparison	8
Table 4	Biological Criteria Reference (BIOREF) Metric Scores, Biological Support Category, and Macroinvertebrate Stream Condition Index (MSCI) Scores, Fall 2011	9
Table 5	Biological Criteria Reference (BIOREF) Metric Scores, Biological Support Category, and Macroinvertebrate Stream Condition Index (MSCI) Scores, Spring 2012.....	10
Table 6	Fall 2011 Macroinvertebrate Community Analysis.....	11
Table 7	Spring 2012 Macroinvertebrate Community Analysis	12
Table 8	Fall 2011 Physicochemical Water Parameters	13
Table 9	Spring 2012 Physicochemical Water Parameters	14
Table 10	Fine Sediment Dissolved Metals Parameters	15

Figures

Figure 1	Mine a Breton Creek Sampling Stations Fall 2011 and Spring 2012.....	3
Figure 2	Mine a Breton Creek Land Use Coverage	5

Attachments

Appendix A	Invertebrate Database Bench Sheet Report: Mine a Breton Creek, Washington County. Grouped by Season and Station
------------	--

1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**) Water Protection Program (**WPP**), the Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a macroinvertebrate bioassessment and habitat study of Mine a Breton Creek, water body identification number (**WBID**) 2101, in Washington County, Missouri. This stream is located in the Ozark/Meramec Ecological Drainage Unit (**EDU**). The primary land use of the Ozark/Meramec EDU is forested land.

Mine a Breton Creek is classified as a class P stream per the Missouri Water Quality Standards (**WQS**) (MDNR 2012a) with the following designated uses: livestock and wildlife watering; protection of warm water aquatic life and human health-fish consumption; and category B whole body contact recreation. A class P stream is defined as a stream that maintains permanent flow even in drought periods. Category B applies to waters designated for whole body contact recreation not contained within category A. Category A whole body contact applies to water segments established as swimming areas.

1.1 Purpose

The purpose of the study was assessment of the habitat characteristics, macroinvertebrate community, and physicochemical characteristics of Mine a Breton Creek to determine if the biological community is impaired.

1.2 Tasks

- 1) Conduct a habitat assessment of Mine a Breton Creek.
- 2) Conduct a bioassessment of the macroinvertebrate community of Mine a Breton Creek.
- 3) Conduct physicochemical monitoring of Mine a Breton Creek.

1.3 Null Hypotheses

- 1) Macroinvertebrate assemblages will not differ among the three Mine a Breton Creek stations.
- 2) Riparian and instream habitat will not differ among the three Mine a Breton Creek stations.
- 3) Macroinvertebrate assemblages will not differ between sample stations on Mine a Breton Creek and biological criteria reference streams located within the Ozark/Meramec EDU.
- 4) Riparian and instream habitat will not differ between sample stations on Mine a Breton Creek and Brazil Creek, a biological criteria candidate reference stream located within the Ozark/Meramec EDU.

2.0 Methods

Macroinvertebrate sampling was conducted during fall 2011 and spring 2012 by Brandy Bergthold and Carl Wakefield of ESP, WQMS. Fall sampling was conducted on

Biological Assessment Report
Mine a Breton Creek, Washington County
Fall 2011 – Spring 2012
Page 2 of 21

September 27, 2011, and consisted of macroinvertebrate sampling, habitat assessments, and water quality sampling at three stations on Mine a Breton Creek. During the spring, sampling was conducted on March 26, 2012, and consisted of macroinvertebrate sampling and water quality sampling at the same three stations. Methods for stream habitat assessments, biological assessments, and physicochemical water quality collection are included in this section. Brandy Bergthold and Mike Irwin, ESP, WQMS, collected sediment samples on November 6, 2012, to analyze for dissolved metals.

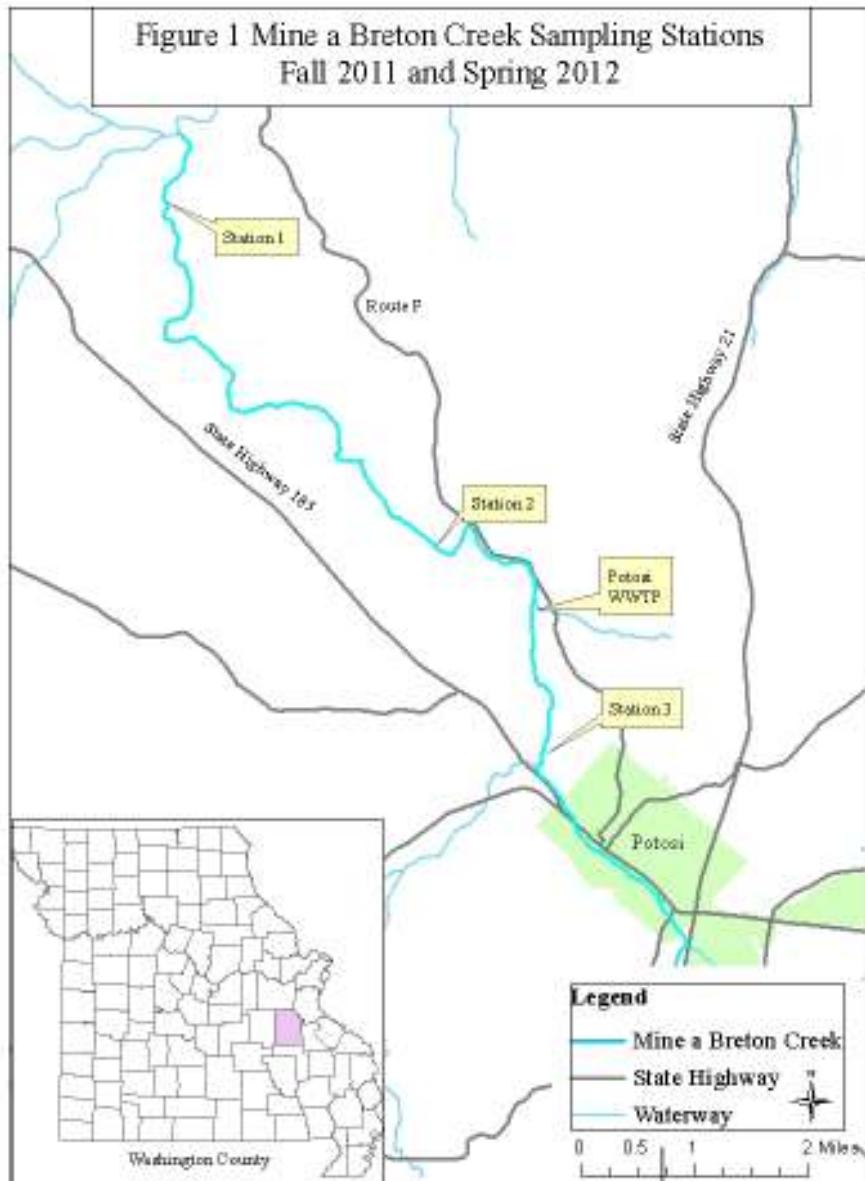
2.1 Station Descriptions

This study included sampling three stations on Mine a Breton Creek in Washington County (Figure 1). Station locations and descriptions are listed below in Table 1. There is a wastewater treatment facility located between stations 2 and 3. A map of the sampling locations can be found in Figure 1.

Table 1
Descriptive Information for the Mine a Breton Creek Stations

Stations	Location-UTM Zone 15	Description	County
Mine a Breton Creek 1	688277 E, 4210500 N	Located on private property off Fir Tree Rd.	Washington
Mine a Breton Creek 2	692156 E, 4205236 N	Located on private property off Jackal Rd.	Washington
Mine a Breton Creek 3	693516 E, 4202369 N	Located at Potosi R-III School District Recreation Complex	Washington

Biological Assessment Report
Mine a Breton Creek, Washington County
Fall 2011 – Spring 2012
Page 3 of 21



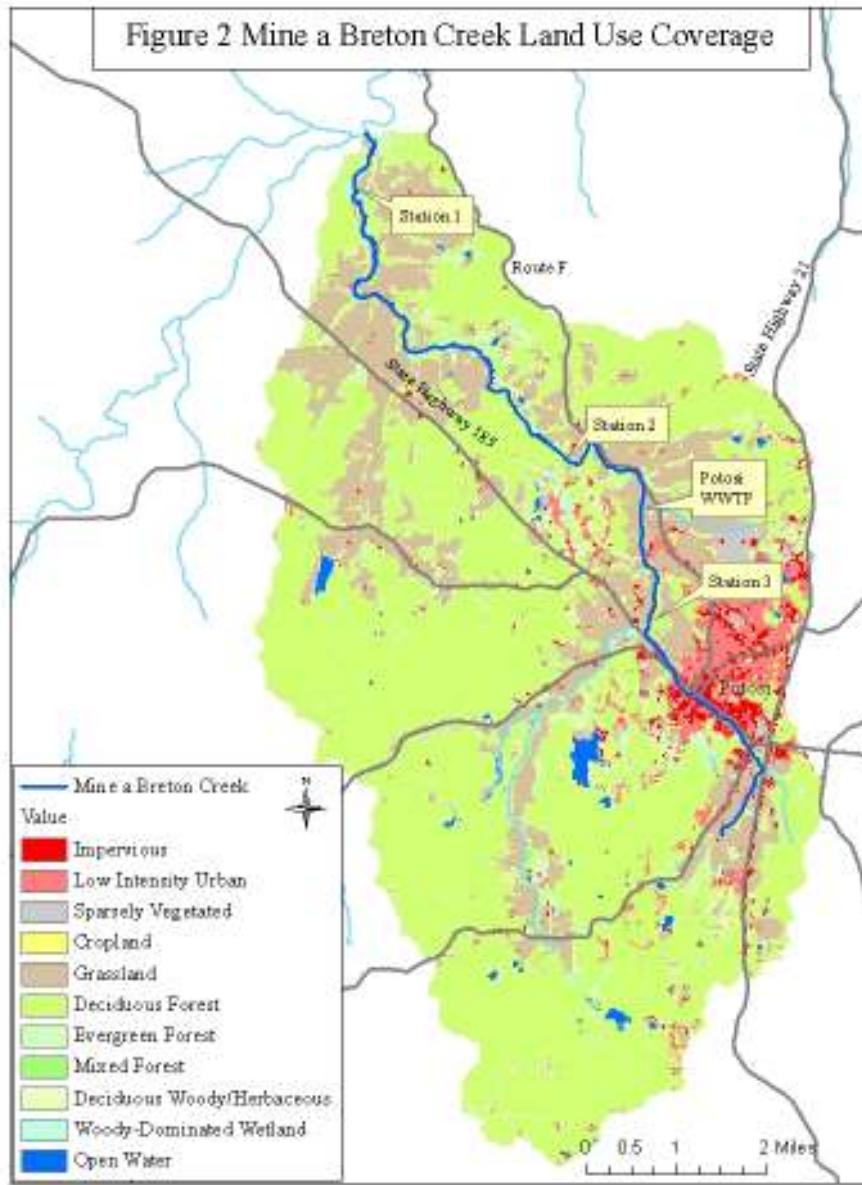
2.1.1 Land Use Description

Mine a Breton Creek is located within the Ozark/Meramec EDU. An EDU is a region in which biological communities and habitat conditions can be expected to be similar.

Table 2 compares the land cover percentages from the Ozark/Meramec EDU and the 12-digit Hydrologic Unit Code (**HUC**) that contains the sampling reaches of the study stations. Percent land use data were derived from Thematic Mapper satellite images from 2000-2004 and interpreted by the Missouri Resource Assessment Partnership (Sowa et al. 2004). Figure 2 depicts the land use of the 12-digit HUC containing Mine a Breton Creek.

Table 2
Percent Land Use in the Mine a Breton
Sampling Stations and the Ozark/Meramec EDU

Stations	12-digit HUC	Non-Vegetated	Crop-land	Grass-land	Forest-land
Mine a Breton Creek 1	071401040201	7.2	<1	21.4	69
Mine a Breton Creek 2	071401040201	7.2	<1	21.4	69
Mine a Breton Creek 3	071401040201	7.2	<1	21.4	69
Ozark/Meramec EDU	-----	4	1	27	62



2.2 Stream Habitat Assessment Project Procedure

Standardized assessment procedures were followed as described for riffle/pool prevalent streams in the Stream Habitat Assessment Project Procedure (SHAPP) (MDNR 2012b). According to the SHAPP, an aquatic community is influenced by the quality of the stream habitat. Stream habitat quality is scored for each station and the scores are compared with a control stream (biological criteria reference reach) SHAPP score. If the

SHAPP score at a test station is $\geq 75\%$ of the SHAPP control score, the stream habitat at the test station is considered to be comparable to the control stream. Brazil Creek, located in Washington County approximately 14 miles west of Potosi, is a candidate reference stream that was chosen as the SHAPP control. The SHAPP scores were calculated for the Mine a Breton Creek stations, compared to the biological criteria reference SHAPP, and examined for irregular results.

2.3 Bioassessment

2.3.1 Macroinvertebrate Sampling and Analyses

Macroinvertebrate sampling was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2010a). Mine a Breton Creek is considered a riffle/pool dominated system. The three standard habitats sampled at all locations were: flowing water over coarse substrate (**CS**); non-flowing water over depositional substrate (**NF**); and rootmat (**RM**). Macroinvertebrate samples were subsampled in the laboratory and identified to specific taxonomic levels (MDNR 2012c) in order to develop biological metrics (MDNR 2010a).

Mine a Breton macroinvertebrate data were evaluated relative to the biological reference streams in the Ozark/Meramec EDU. Biological criteria are calculated separately for the fall (mid-September through mid-October) and spring (mid-March through mid-April) index periods. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index (**MSCI**). The four components of the MSCI are: Taxa Richness (**TR**); Ephemeroptera, Plecoptera, and Trichoptera Taxa (**EPTT**); Biotic Index (**BI**); and the Shannon Diversity Index (**SDI**). An MSCI score of 16-20 is considered fully supporting, 10-14 partially supporting, and 4-8 non-supporting of the protection of warm water aquatic life beneficial use designation as listed in the Missouri Water Quality Standards (MDNR 2012a).

2.3.2 Physicochemical Water Sampling and Analyses

Physicochemical water samples were handled according to the appropriate MDNR ESP Standard Operating Procedure (**SOP**) or Project Procedure (**PP**). Results for physicochemical water parameters were examined by season and station. All physicochemical water parameters were sampled by field measurements or grab samples collected in accordance with the SOP MDNR-ESP-001, Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2011). All samples were kept on ice during transport to ESP.

Water quality parameters were measured *in-situ* or collected and returned for analyses at the state environmental laboratory. Temperature ($^{\circ}\text{C}$) (MDNR 2012d), pH (MDNR 2012e), specific conductance ($\mu\text{S}/\text{cm}$) (MDNR 2010b), dissolved oxygen (mg/L) (MDNR 2012f), and discharge (cubic feet per second-cfs) (MDNR 2010c) were measured in the field. Turbidity (**NTU**) (MDNR 2010d) was measured and recorded in the ESP, WQMS biology laboratory. The ESP Chemical Analysis Section (**CAS**) in Jefferson City,

Missouri, conducted the analyses for ammonia-nitrogen (mg/L), nitrate+nitrite-nitrogen (mg/L), total nitrogen (mg/L), chloride (mg/L), non-filterable residue (mg/L), total phosphorus (mg/L), and for the following dissolved metals ($\mu\text{g}/\text{L}$): barium, cadmium, cobalt, copper, lead, nickel, and zinc.

Physicochemical water parameters were compared among stations as well as with Missouri's WQS (MDNR 2012a). Interpretation of acceptable limits in the WQS may be dependent on a stream's classification and its beneficial use as designated in the WQS (MDNR 2012a).

2.3.3 Fine Sediment Dissolved Metals Characterization

Fine sediment was sampled at each station. A total of three 2-ounce grab samples were composited for each station. The fine sediment was subsampled and analyzed for total cadmium, lead, and zinc by CAS. Temperature ($^{\circ}\text{C}$) (MDNR 2012d), pH (MDNR 2012e), specific conductance ($\mu\text{S}/\text{cm}$) (MDNR 2010b), and dissolved oxygen (mg/L) (MDNR 2012f) were measured in the field at the time of fine sediment collection.

The consensus-based Probable Effects Concentration (PEC) for cadmium, lead, and zinc (MacDonald et al. 2000) was compared to levels found in the fine sediment material. A PEC is the level of a contaminant above which harmful effects are likely to be observed. The PEC for lead is 128 mg/kg dry weight; the PEC for cadmium is 4.98 mg/kg; and the PEC for zinc is 459 mg/kg.

2.3.4 Discharge

Stream flow was measured using a SonTek/YSI FlowTracker Handheld Acoustic Doppler Velocimeter[®] at each station during both sampling seasons and in accordance with the SOP MDNR-ESP-113, Flow Measurement in Open Channels (MDNR 2010c).

3.0 Results and Analyses

3.1 Land Use

The land use data in Table 2 provide a comparison between the 12-digit hydrologic units covered within the study reach of the Mine a Breton Creek and the Ozark/Meramec EDU. Test stations in this study had the following land use proportions: 7.2% non-vegetated, <1% cropland, 21.4% grassland, and 69% forested land. Comparison of the percent land use of the EDU and the 12-digit HUCs containing the study segments showed the land use to be very similar. The Ozark/Meramec EDU had slightly less urban land and forested land with greater amounts of grassland compared to the Mine a Breton watershed. Cropland was similar between the EDU and the Mine a Breton Creek HUCs.

3.2 Stream Habitat Assessment

Scoring results of the habitat assessment are found in Table 3. If the study station SHAPP score is $\geq 75\%$ of the control station score, the stations are considered to contain comparable habitats. Comparable habitats should be able to support comparable biological communities. All stations scored $\geq 75\%$ of the SHAPP control, Brazil Creek, with the two downstream stations scoring higher than the control site. Based on SHAPP scores, it is inferred that the Mine a Breton Creek stations have habitats similar to the candidate reference (control) stream and should, therefore, support a comparable biological community.

Table 3
Stream Habitat Assessment Scores and Percentage Comparison

Station	Score	% of Reference
Mine a Breton Creek 1	137	>100%
Mine a Breton Creek 2	136	>100%
Mine a Breton Creek 3	120	95%
Brazil Creek (SHAPP Control)	126	-----

Stations 1 and 2 were located on private property at the end of dead end roads. Station 2 is located approximately two miles downstream of the Potosi wastewater treatment plant. Station 3 was located just southeast of the Potosi R-III School District Recreation Complex on Highway 185. Mine a Breton Creek flows through Potosi upstream of station 3. Within Potosi, the stream riparian area is mowed up to the stream bank and takes on characteristics of a maintained ditch.

Mine a Breton Creek had ample epifaunal substrate available at stations 1 and 2 with a variety of cobble and gravel sized materials in the stream, minimal amounts of sediment deposition, and gravel bars present along the margins of the banks. Station 2 had areas of larger cobble along the bluff area within the stream reach. Station 3 had a lesser amount of larger sized substrate and increased amounts of sediment deposition. Riffle quality was best at station 1. The riffles at stations 2 and 3 were shorter than station 1 relative to the width of the stream. Stations 1 and 2 had a variety of depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Station 3 lacked the fast-deep depth regime. Station 2 had a rock bluff along part of the stream reach with very large cobble sized substrate. Riffle quality was suitable at all three stations. No channelization was present at any of the stations. Bank stability was good at stations 2 and 3; however, there was some bank erosion occurring along the left bank at station 1, whereas the right bank was in good condition. Vegetative protection along the banks scored fairly low at each station, which may be partly due to the rocky nature of the stream banks. Station 1 had well established riparian areas on either side of the stream with a good mix of trees, understory growth, and grasses. The riparian area was fully established along the left bank at station 2, but the right bank riparian zone and vegetative protection was partially impaired by a pasture area. Station 3 had a fully established riparian area along the right

bank and limited riparian cover along the left bank due to maintenance of the ball park and a pasture adjacent to the ball park.

Brazil Creek, the SHAPP control, had good epifaunal substrate and well developed riffles with low embeddedness but lacked deep flow regimes. A moderate amount of sediment deposition was present throughout the stream channel. The stream reach lacked any evidence of channelization and had optimal riparian areas with very good bank stability. Vegetative protection along the banks ranked fairly low, but this may be partly due to the rocky nature of the area. In addition, bluffs were present along the reach of the stream assessed for habitat quality.

3.3 Biological Assessment and Macroinvertebrate Community Analyses

Tables 4 and 5 provide scoring criteria and results for the fall and spring index periods, respectively. MSCI scores were calculated by scoring station metrics against the appropriate biological criteria reference stream (**BIOREF**) scores located in the tables. An MSCI score of 16-20 is considered fully supporting, 10-14 is partially supporting, and 4-8 is considered non-supporting.

Mine a Breton Creek station 1 scored a fully biologically supporting MSCI ranking during both sampling seasons. Station 2 scored fully supporting during the fall sampling season and partially supporting during the spring. Station 3 scored partially supporting during the fall and fully supporting during the spring sampling season.

Table 4
 Biological Criteria Reference (BIOREF) Metric Scores, Biological Support Category,
 and Macroinvertebrate Stream Condition Index (MSCI) Scores, Fall 2011

Stations	Sample No.	TR	EPTT	BI	SDI	MSCI	Support
Mine a Breton Creek 1	110992	85	24	5.6	3.19	20	Full
Mine a Breton Creek 2	110993	90	24	6.3	2.66	16	Full
Mine a Breton Creek 3	110994	79	19	6.0	3.14	14	Partial
BIOREF Score=5		>79	>21	<5.8	>3.09	20-16	Full
BIOREF Score=3		79-39	21-11	5.8-7.9	3.09-1.55	14-10	Partial
BIOREF Score=1		<39	<11	>7.9	<1.55	8-4	Non

MSCI Scoring Table (in light gray) developed from BIOREF streams (n = 7). TR=Taxa Richness; EPTT=Ephemeroptera, Plecoptera, Trichoptera Taxa; BI=Biotic Index; SDI=Shannon Diversity Index

Biological Assessment Report
 Mine a Breton Creek, Washington County
 Fall 2011 – Spring 2012
 Page 10 of 21

Table 5
 Biological Criteria Reference (BIOREF) Metric Scores, Biological Support Category,
 and Macroinvertebrate Stream Condition Index (MSCI) Scores, Spring 2012

Stations	Sample No.	TR	EPTT	BI	SDI	MSCI	Support
Mine a Breton Creek 1	120026	99	29	5.6	3.45	18	Full
Mine a Breton Creek 2	120027	90	21	6.8	2.77	12	Partial
Mine a Breton Creek 3	120028	103	25	5.9	3.43	16	Full
BIOREF Score=5		>92	>29	<5.8	>3.33	20-16	Full
BIOREF Score=3		92-46	29-15	5.8-7.9	3.33-1.67	14-10	Partial
BIOREF Score=1		<46	<15	>7.9	<1.67	8-4	Non

MSCI Scoring Table (in light gray) developed from BIOREF streams (n = 6). TR=Taxa Richness;
 EPTT=Ephemeroptera, Plecoptera, Trichoptera Taxa; BI=Biotic Index; SDI=Shannon Diversity Index

The fall 2011 macroinvertebrate community analysis is shown in Table 6. Ephemeroptera composed more than 50% of the biological community at stations 1 and 2 and just under 50% of the community at station 3. The total percentage of EPT taxa ranged from 59.1% to 73.8%. Stations 1 and 2 lacked Plecoptera while station 3 had <0.1% Plecoptera in the biological community. Trichoptera was present at all three stations, with stations 2 and 3 having almost twice the amount of Trichoptera compared to station 1. Dipteran taxa ranged from 13.2% to 15.8%. Leptohyphidae was the most common family at station 1 while Caenidae was the most common family at stations 2 and 3. Chironomidae was abundant at all three stations.

Tricorythodes sp. was the dominant taxon at station 1. *Caenis latipennis* and *Baetis* sp. were not as abundant but were common at station 1. *Caenis latipennis* was collected in extremely high numbers, particularly in the non-flow habitat, at stations 2 and 3 during the fall. *Cheumatopsyche* sp. was also common at stations 2 and 3. *Baetis* sp. and *Isonychia bicolor* were abundant at station 2 but were collected in lesser numbers at station 3. *Optioservus sandersoni* was common at station 2 and *Maccaffertium pulchellum* was common at station 3. Chironomidae were distributed among many taxa, but no single one was dominant.

Table 6
 Fall 2011 Macroinvertebrate Community Analysis

Fall 2011					
Mine a Breton Creek 1		Mine a Breton Creek 2		Mine a Breton Creek 3	
Order	%	Order	%	Order	%
Ephemeroptera	58	Ephemeroptera	56.2	Ephemeroptera	44
Plecoptera	0.0	Plecoptera	0.0	Plecoptera	<0.1
Trichoptera	7.6	Trichoptera	17.6	Trichoptera	15.1
Total EPT%	65.6	Total EPT%	73.8	Total EPT%	59.1
Diptera	15.8	Diptera	13.2	Diptera	13.4
Dominant Macroinvertebrate Families					
Family	%	Family	%	Family	%
Leptohyphidae	26	Caenidae	35	Caenidae	23.5
Chironomidae	13.3	Hydropsychidae	16.5	Chironomidae	12.4
Caenidae	10.9	Chironomidae	11.6	Hydropsychidae	12.4
Baetidae	8.7	Baetidae	7.3	Elmidae	8.5
Elmidae	8.4	Isonychiidae	6.5	Heptageniidae	7.2
Heptageniidae	5.9	Heptageniidae	6.3	Baetidae	6.8

The spring 2012 macroinvertebrate community analysis is shown in Table 7. All stations had EPT taxa present with total EPT taxa ranging from 20.0% to 49.3%. Dipteran taxa were present in higher numbers during the fall, ranging from 40.0% to 71.2%. Chironomidae and Leptohyphidae made up almost 57% of the taxa at station 1. Chironomidae and Caenidae made up almost 80% of the taxa at station 2 and 65% of the taxa at station 3.

As in the fall, *Tricorythodes* sp. was the dominant taxon at station 1. Several Chironomidae were abundant at stations 2 and 3, including *Dicrotendipes* sp., *Cricotopus/Orthocladius* sp., and *Rheotanytarsus* sp. *Caenis latipennis* was also common at stations 2 and 3. *Maccaffertium pulchellum* was, again, common at station 3. Several Trichoptera and Plecoptera taxa were present; however, none were excessively abundant.

Table 7
 Spring 2012 Macroinvertebrate Community Analysis

Spring 2012					
Mine a Breton Creek 1		Mine a Breton Creek 2		Mine a Breton Creek 3	
Order	%	Order	%	Order	%
Ephemeroptera	39.1	Ephemeroptera	16.2	Ephemeroptera	19.5
Plecoptera	1.2	Plecoptera	0.2	Plecoptera	1.6
Trichoptera	9.0	Trichoptera	3.6	Trichoptera	7.1
Total EPT%	49.3	Total EPT%	20.0	Total EPT%	28.2
Diptera	40	Diptera	71.2	Diptera	62.2
Dominant Macroinvertebrate Families					
Family	%	Family	%	Family	%
Chironomidae	35.8	Chironomidae	67.6	Chironomidae	57
Leptohyphidae	20.9	Caenidae	11.6	Caenidae	8.3
Hydropsychidae	7	Hydropsychidae	3.0	Heptageniidae	8.2
Heptageniidae	4.7	Simuliidae	2.6	Hydropsyche	5.2
Isonychidae	4.2	Elmidae	2.1	Simuliidae	2.3
Caenidae	4.2	Heptageniidae	2.0	Empididae	2.1

3.4 Physicochemical Water Parameters

Physicochemical results can be found in Tables 8 and 9. The physicochemical results for both seasons were fairly consistent throughout the watershed. Dissolved oxygen levels were of good quality, ranging from 8.96 mg/L to 11.13 mg/L during the fall sampling period and from 10.15 mg/L to 12.12 mg/L during the spring. Flow measurements ranged from 5.1 cfs to 22.2 cfs during the fall sampling period and from 15.1 cfs to 36.6 cfs during the spring. Turbidity was relatively low during both seasons. The highest turbidity value reported was 2.65 NTU during the spring sampling season at station 1. When compared to the values in the Missouri WQS, the physicochemical water quality parameters analyzed for this study were not elevated during either season and likely did not have an effect on the biological community during the study seasons.

With the exception of zinc and barium, the dissolved metals evaluated during the study (cadmium, cobalt, copper, and lead) had concentrations that were below laboratory detectable limits or practical quantitation limits. Dissolved zinc ranged from 9.22 µg/L to 56.2 µg/L in the fall and 15 µg/L to 24.6 µg/L in the spring; each of these values is less than the WQS acute and chronic criteria. Dissolved barium, which ranged from 572 µg/L to 690 µg/L in the fall and 297 µg/L to 494 µg/L in the spring, was below the WQS established for drinking water supply and groundwater.

Although there are currently no nutrient criteria in use for Missouri streams and rivers, the values for each season were compared to the United States Environmental Protection Agency's (USEPA) December 2000 Ambient Water Quality Criteria Recommendations

Biological Assessment Report
 Mine a Breton Creek, Washington County
 Fall 2011 – Spring 2012
 Page 13 of 21

for Rivers and Streams in Nutrient Ecoregion XI (USEPA 2000). USEPA's recommended values are as follows: 0.093 mg/L nitrate + nitrite, 0.31 mg/L total nitrogen, 0.01 mg/L total phosphorus, and 2.3 NTU turbidity. According to this information, nitrate + nitrite and total nitrogen were elevated at all three stations during both seasons. Total phosphorus values were also in exceedance of EPA's recommended criteria at stations 1 and 2 during both seasons. Turbidity did not exceed USEPA's recommended 2.3 NTU during the fall but was slightly elevated during the spring sampling season at station 1. The values at stations 2 and 3 were below 2.3 NTU during the spring. The nutrient values obtained during the fall sampling period were slightly higher than during the spring.

Table 8
 Fall 2011 Physicochemical Water Parameters

Parameters	Stations	Mine a Breton Creek 1	Mine a Breton Creek 2	Mine a Breton Creek 3
Dissolved Barium ($\mu\text{g}/\text{L}$)		690	607	572
Dissolved Cadmium ($\mu\text{g}/\text{L}$)		<0.1*	<0.1*	0.12**
Dissolved Cobalt ($\mu\text{g}/\text{L}$)		<1*	<1*	<1*
Dissolved Copper ($\mu\text{g}/\text{L}$)		0.53**	0.72**	0.56**
Dissolved Lead ($\mu\text{g}/\text{L}$)		<0.5*	<0.5*	0.60**
Dissolved Nickel ($\mu\text{g}/\text{L}$)		<0.5*	0.51**	<0.5*
Dissolved Zinc ($\mu\text{g}/\text{L}$)		9.22	26.7	56.2
Dissolved Calcium (mg/L)		64.1	60.1	59.8
Dissolved Magnesium (mg/L)		39.4	36.6	37
Ammonia as N (mg/L)		<0.03*	<0.03*	<0.03*
Chloride (mg/L)		7.59	12	8.79
Dissolved Oxygen (mg/L)		8.96	11.13	9.99
pH (su)		8.2	8.3	8.2
Specific Conductance ($\mu\text{S}/\text{cm}$)		574	593	578
Temperature ($^{\circ}\text{C}$)		15.4	16.1	17.3
Turbidity (NTU)		1.19	1.43	0.64
Flow (cfs)		22.2	9.1	5.1
Hardness as CaCO_3 (mg/L)		322	301	302
Nitrate+Nitrite as N (mg/L)		0.68	1.09	0.54
Non-Filterable Residue (mg/L)		<5*	<5*	<5*
Total Nitrogen (mg/L)		0.7	1.13	0.56
Total Phosphorus (mg/L)		0.03**	0.11	<0.01*

* Below detectable limits

** Estimated value, detected below PQL

Table 9
 Spring 2012 Physicochemical Water Parameters

Parameters	Stations	Mine a Breton Creek 1	Mine a Breton Creek 2	Mine a Breton Creek 3
Dissolved Barium ($\mu\text{g/L}$)		494	376	297
Dissolved Cadmium ($\mu\text{g/L}$)		<0.1*	<0.1*	<0.1*
Dissolved Cobalt ($\mu\text{g/L}$)		<1*	<1*	<1*
Dissolved Copper ($\mu\text{g/L}$)		0.60**	0.79**	0.58**
Dissolved Lead ($\mu\text{g/L}$)		<0.5*	<0.5*	<0.5*
Dissolved Nickel ($\mu\text{g/L}$)		1.04	0.98**	0.89**
Dissolved Zinc ($\mu\text{g/L}$)		15	22	24.6
Dissolved Calcium (mg/L)		47.9	43	40.3
Dissolved Magnesium (mg/L)		28.1	25.3	23.9
Ammonia as N (mg/L)		<0.03*	<0.03*	<0.03*
Chloride (mg/L)		6.81	7.98	6.12
Dissolved Oxygen (mg/L)		10.15	12.12	10.79
pH (su)		8.5	8.6	8.3
Specific Conductance ($\mu\text{S/cm}$)		450	413	383
Temperature ($^{\circ}\text{C}$)		15.8	17.3	18.4
Turbidity (NTU)		2.65	1.26	1.62
Flow (cfs)		36.6	20.7	15.1
Hardness as CaCO_3 (mg/L)		235	212	199
Nitrate+Nitrite as N (mg/L)		0.45	0.29	0.26
Non-Filterable Residue (mg/L)		<5*	<5*	<5*
Total Nitrogen (mg/L)		0.52	0.41	0.34
Total Phosphorus (mg/L)		0.04**	0.06	<0.01*

* Below detectable limits

** Estimated value, detected below PQL

3.5 Fine Sediment Dissolved Metals Parameters

The fine sediment dissolved metals results are shown in Table 10. Total metals concentrations in the fine sediment were compared to the consensus based PECs for cadmium, lead, and zinc (MacDonald et al. 2000). Cadmium was detected at levels below the PEC of 4.98 mg/kg at all three stations. The PEC for lead is 128 mg/kg dry weight. Lead was elevated at stations 2 and 3, with concentrations of 151 mg/kg and 198 mg/kg, respectively. Zinc was elevated only at station 2. The PEC for zinc is 459 mg/kg and the value at station 2 was 470 mg/kg.

Table 10
 Fine Sediment Dissolved Metals Parameters

Stations	Mine a Breton Creek 1	Mine a Breton Creek 2	Mine a Breton Creek 3
Parameters			
Dissolved Cadmium (mg/kg)	0.351***	0.883*	0.605*
Dissolved Lead (mg/kg)	70.1	151	198
Dissolved Zinc (mg/kg)	252	470	255
Dissolved Oxygen (mg/L)	12.95	12.52	10.81
pH (su)	8.6	8.5	8.6
Specific Conductance ($\mu\text{S}/\text{cm}$)	512	542	512
Temperature ($^{\circ}\text{C}$)	10.6	10.5	10.6
Percent Moisture (%)	20.0	15.6	21.6

* Estimated value, matrix interference

** Estimated value, detected below PQL

bold = above the PEC

4.0 Discussion

Comparison of the land use of the EDU and the 12-digit HUC that contains the Mine a Breton Creek study segments showed the study stations had slightly more urban and forested land and less grassland than the EDU as a whole. The EDU had similar coverage of cropland as the study stations. There were no substantial differences in land use between the HUC containing the study stream and the EDU as a whole.

The SHAPP scores for all three Mine a Breton Creek stations were >75% of the Brazil Creek SHAPP control stream score. The majority of the individual categories for the SHAPP scored well. Sediment deposition was present throughout the stream reach but did not appear excessive. Vegetative protection of the banks ranked fairly low at each station likely due to the rocky nature of the banks and the presence of rocky bluff areas. In addition, the riparian vegetative zone width ranked low (less than six meters vegetative width) along at least one side of the stream reach for stations 2 and 3. Station 1 had a full riparian area (greater than 18 meters) along both sides of the reach. Station 1 was fairly wide and was located approximately 0.7 miles from the creek's confluence with Mineral Fork. The creek meanders through nearly five miles of forest, cropland, and grasslands between stations 1 and 2. Station 2 was located downstream of a wastewater treatment facility. The stream meanders along State Highway F and through residential areas for three miles between stations 2 and 3, which is presumably the source of trash found instream and along the banks during both sampling seasons at station 2. The Potosi city limit boundary is located 0.5 miles upstream of station 3. Through Potosi, the stream is maintained as it flows through residential and commercial areas and lacks vegetative protection in the riparian zone.

When compared to Ozark/Meramec EDU biological criteria reference data, station 1 attained an MSCI score in the fully supporting range for both the fall and spring sampling seasons. However, the station 2 MSCI score was in the fully supporting category during

Biological Assessment Report
Mine a Breton Creek, Washington County
Fall 2011 – Spring 2012
Page 16 of 21

the fall and partially supporting during the spring. Station 3 MSCI scores exhibited the opposite trend, with a partially supporting score during the fall and fully supporting during the spring. Station 3 scored suboptimal for the categories of TR, EPTT, and BI during the fall. The presence of a single additional taxon during the fall, however, would have elevated the taxa richness metric into the optimal category and resulted in a fully supporting fall MSCI score. Station 2 scored suboptimal for all four biological metrics (TR, EPTT, BI, and SDI) during the spring.

Macroinvertebrate abundance was high. For most sites during the fall, less than 5% of the habitats at each station were subsampled to reach the target numbers. The two exceptions were the rootmat at station 2 (8.33% was subsampled) and the riffle habitat at station 3 (6.25% was subsampled). During the spring less than 5% of the habitats were subsampled at each station to reach the target number except for one site; 6.25% of the riffle habitat at station 3 was subsampled to reach the target number.

The physicochemical data revealed all values to be fairly consistent for each sampling season. Aside from elevated nutrient levels, the physicochemical data do not show any significant trends. It appears that physicochemical water quality did not affect the biological community during the study seasons. It is hard to conclude if the elevated nutrient levels had any effect on the macroinvertebrate community and the MSCI scores.

Total metals concentrations in the fine sediment revealed lead and zinc concentrations to be elevated at the upstream stations. Station 2 had elevated levels of both lead and zinc, whereas station 3 had only elevated levels of lead. At station 1 cadmium, lead, and zinc concentrations were below the PEC. Past research regarding metals in fine sediment has determined specific mayfly taxa (Heptageniidae, *Isonychia bicolor*, and *Tricorythodes* sp.) and Tanytarsini chironomids are negatively affected by increased metals concentrations in the fine sediment (Clements et al. 1988, Clements et al. 1992, Clements et al. 2000). The following Heptageniidae taxa were present in Mine a Breton Creek during both seasons: *Maccaffertium mediopunctatum*, *Maccaffertium pulchellum*, *Stenacron* sp., and immature specimens identified to the generic level as Heptageniidae. *Maccaffertium mediopunctatum* was collected at all stations during both seasons. *Maccaffertium pulchellum* was more common at station 3 during both seasons versus stations 1 and 2. *Stenacron* sp. was absent at station 1 and only a few specimens were collected at stations 2 and 3 and during each season. *Isonychia bicolor* was collected at all three stations each season and was a fairly common taxon at station 2 during the fall. *Tricorythodes* sp. was abundant at station 1 during both seasons. The Tanytarsini taxa *Paratanytarsus* sp., *Rheotanytarsus* sp., and *Tanytarsus* sp. had decreased numbers at station 2 during the fall. However, during the spring, *Rheotanytarsus* sp. and *Tanytarsus* sp. were fairly consistent at all three stations. *Paratanytarsus* sp. is absent from station 1 during the spring but present at stations 2 and 3. Clements et al. (1988) also determined sites with elevated levels of metals in the fine sediment had higher numbers of Hydropsychidae. Station 2, which scored fully supporting during the fall, had much greater numbers of the Hydropsychidae *Cheumatopshye* sp. than station 3, which scored

partially supporting. In review of the taxa composition, it is difficult to conclude if the elevated levels of lead and zinc were contributing factors in the partially supporting scores obtained at stations 2 and 3 as the MSCI scoring was not consistent for both seasons and the taxa commonly affected by elevated metals in the fine sediment did not reveal any specific trends.

5.0 Conclusion

Four null hypotheses were stated in the introduction: 1) macroinvertebrate assemblages will not differ among the three Mine a Breton Creek stations; 2) riparian and instream habitat will not differ among the three Mine a Breton Creek stations; 3) macroinvertebrate assemblages will not differ between sample stations on Mine a Breton Creek and biological criteria reference streams located within the Ozark/Meramec EDU; and 4) riparian and instream habitat will not differ between sample stations on Mine a Breton Creek and Brazil Creek, a candidate reference stream located within the Ozark/Meramec EDU.

Null hypothesis #1 is rejected. The dominant taxa at Mine a Breton Creek varied among the three stations. Stations 1 and 2 scored similarly, fully supporting, during the fall sampling period. Station 3 scored partially supporting during the fall with lower taxa richness and Ephemeroptera, Plecoptera, Trichoptera taxa compared to stations 1 or 2. During the spring, stations 1 and 3 both had fully supporting MSCI scores and station 2 scored partially supporting. Taxa richness and Shannon Diversity Index scored lower at station 2 when compared to stations 1 and 3.

Null hypothesis #2 is accepted. The SHAPP scores for the three Mine a Breton Creek stations differed by only 17 points. Stations 1 and 2 had the highest SHAPP scores of the three sample sites and were within 1 point of one another. As the SHAPP scores imply, the habitat quality of the three Mine a Breton Creek stations was comparable.

Null hypothesis #3 is accepted for station 1 and rejected for stations 2 and 3. Reference streams within the EDU represent the best available conditions and are the basis for calculating MSCI scores. Only station 1 scored fully supporting during both seasons, indicating a similar macroinvertebrate community compared to the biological criteria reference streams located within the Ozark/Meramec EDU. Stations 2 and 3 each scored partially supporting during opposing seasons, indicating the stations did not have macroinvertebrate assemblages comparable to the biological criteria reference streams located within the Ozark/Meramec EDU during those times.

Null hypothesis #4 is accepted. The SHAPP scores of the study stations all scored >75% of the SHAPP control stream. The habitat quality of Mine a Breton Creek is comparable to the biological criteria reference station on Brazil Creek.

Macroinvertebrate communities can be affected by a multitude of parameters. The habitat assessment did not reveal any specific factors that would produce impairments of

Biological Assessment Report
Mine a Breton Creek, Washington County
Fall 2011 – Spring 2012
Page 18 of 21

the biological community. Ample cover was available to the macroinvertebrates; all stations had adequate epifaunal cover and instream habitat. In addition to the gravel and cobble instream, submerged logs, undercut banks, and rootmats were prevalent at all stations. The vegetative protection of the riparian area was well established at station 1 along both banks providing cover and shade to the stream. Stations 2 and 3 had fully established riparian areas along one bank but limited riparian areas along the opposing bank. There was no evidence of channelization at any of the stations. Although instream habitat ranked fairly well at each station, factors throughout the watershed may have contributed to the lower biological sustainability at stations 2 and 3 during opposing seasons. Urbanized areas were more common in the upper portion of the watershed. The physicochemical results indicated elevated nutrients at the three stations with the exception of total phosphorus at station 3. In addition, elevated lead was detected in the fine sediment at stations 2 and 3 as well as elevated zinc in the fine sediment at station 3. Few other definitive trends in the physicochemical characteristics besides typical seasonal differences occurred. Overall, the bioassessment for Mine a Breton Creek, WBID 2101, suggests that a biological impairment does exist within the stream, particularly upstream of station 1. The MSCI scores for station 1 were consistent and showed no impairment in this reach. However, the MSCI scores for stations 2 and 3 were not consistent during the sampling event and each exhibited impairment during one sample season.

6.0 Literature Cited

- Clements, W.H., D.S. Cherry, and J. Cairns, Jr. 1988. Impact of Heavy Metals on Insect Communities in Streams. A Comparison of Observational and Experimental Results. Canadian Journal of Fisheries and Aquatic Sciences 45:2017-2025.
- Clements, W.H., D.S. Cherry, and J.H. Van Hassel. 1992. Assessment of the Impact of Heavy Metals on Benthic Communities at the Clinch River (Virginia): Evaluation of an Index of Community Sensitivity. Canadian Journal of Fisheries and Aquatic Sciences 49:1686-1694.
- Clements, W.H., D.M. Carlisle, J.M. Lazorchak, J.M and Johnson, P.C. 2000. Heavy Metals structure benthic communities in Colorado mountain streams. Ecological Applications 10:626-638.
- Missouri Department of Natural Resources. 2012a. Title 10. Rules of Department of Natural Resources Division 20-Clean Water Commission, Chapter 7-Water Quality. 10 CSR 20-7.031 Water Quality Standards. pp. 10-136.
- Missouri Department of Natural Resources. 2012b. Stream Habitat Assessment Project Procedure. Environmental Services Program, P.O. Box 176, Jefferson City, Missouri. 40 pp.
- Missouri Department of Natural Resources. 2012c. Taxonomic Levels for Macroinvertebrate Identifications. MDNR-ESP-209. Environmental Services Program, P.O. Box 176, Jefferson City, Missouri. 33 pp.
- Missouri Department of Natural Resources. 2012d. Field Measurement of Water Temperature. MDNR-ESP-101. Environmental Services Program. P.O. Box 176, Jefferson City, Missouri. 3 pp.
- Missouri Department of Natural Resources. 2012e. Field Analysis of Water Samples for pH. MDNR-ESP-100. Environmental Services Program. P.O. Box 176, Jefferson City, Missouri. 8 pp.
- Missouri Department of Natural Resources. 2012f. Sample Collection and Field Analysis of Dissolved Oxygen Using a Membrane Electrode Meter. MDNR-ESP-103. Environmental Services Program. P.O. Box 176, Jefferson City, Missouri. 16 pp.
- Missouri Department of Natural Resources. 2011. Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations. MDNR-ESP-001. Environmental Services Program, P.O. Box 176, Jefferson City, Missouri. 24 pp.

Biological Assessment Report
Mine a Breton Creek, Washington County
Fall 2011 – Spring 2012
Page 20 of 21

Missouri Department of Natural Resources. 2010a. Semi-Quantitative Macroinvertebrate Stream Bioassessment Project Procedure. Environmental Services Program, P.O. Box 176, Jefferson City, Missouri. 26 pp.

Missouri Department of Natural Resources. 2010b. Field Analysis of Specific Conductivity in Water. MDNR-ESP-102. Environmental Services Program. P.O. Box 176, Jefferson City, Missouri. 9 pp.

Missouri Department of Natural Resources. 2010c. Flow Measurements in Open Channels. MDNR-ESP-113. Environmental Services Program, P.O. Box 176, Jefferson City, Missouri. 12 pp.

Missouri Department of Natural Resources. 2010d. Analysis of Turbidity Using the Hach 2100P Portable Turbidimeter. MDNR-ESP-012. Environmental Services Program. P.O. Box 176, Jefferson City, Missouri. 8 pp.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contam. Toxicol.* 39: 20-31.

Sowa, S.P., D.D. Diamond, R.A. Abbott, G.M. Annis, T. Gordon, M.E. Morey, G.R. Sorensen, and D. True. 2004. Final Report of The Aquatic Component of GAP Analysis: A Missouri Prototype. Missouri Resource Assessment Partnership (MoRAP), University of Missouri. 111 pp.

United States Environmental Protection Agency. 2000. Ambient Water Quality Criteria Recommendations. Information Supporting the Development of State and Tribal Nutrient Criteria for River and Streams in Nutrient Ecoregion IX. United States Environmental Protection Agency, Office of Water, Washington, D.C., EPA-822-B-00-019. 32 pp.

Biological Assessment Report
Mine a Breton Creek, Washington County
Fall 2011 – Spring 2012
Page 21 of 21

Submitted by:

Brandy Bergthold
Environmental Specialist III
Water Quality Monitoring Section
Environmental Services Program

Date:

Approved by:

Alan Reinkemeyer
Director
Environmental Services Program

AR:bbt

c: Trish Rielly, WPP
Jackson Bostic, SERO

Appendix A

Invertebrate Database Bench Sheet Report:
Mine a Breton Creek, Washington County
Grouped by Season and Station

Aquid Invertebrate Database Bench Sheet Report

Mine a Breton Cr [110992], Station #1, Sample Date: 9/27/2011 9:15:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3	13	5
AMPHIPODA			
Hyalella azteca			10
Stygbromus		3	
COLEOPTERA			
Berosus			3
Dubiraphia		23	43
Ectopria nervosa	-99		
Macronychus glabratus			1
Microcylloepus pusillus			8
Optioservus sandersoni	24	8	7
Psephenus herricki	-99	-99	
Stenelmis		15	
DECAPODA			
Orconectes luteus			-99
Orconectes medius	-99		-99
DIPTERA			
Ablabesmyia		7	2
Atherix	-99	-99	-99
Ceratopogoninae		6	
Chironomidae		3	1
Cladotanytarsus		1	
Corynoneura		10	1
Cricotopus bicinctus			2
Cricotopus/Orthocladius	3	4	10
Dicrotendipes		10	1
Forcipomyiinae			1
Hemerodromia		2	2
Labrundinia		3	2
Natarsia		2	
Parakiefferiella		1	
Paratanytarsus		2	13
Phaenopsectra		6	2
Polypedilum convictum	5	4	
Polypedilum illinoense grp	1	3	4
Procladius		1	
Pseudochironomus		4	2
Rheotanytarsus	15	4	4
Simulium	22		5
Stempellinella		4	
Stenochironomus			3
Tanytarsus		32	20
Thienemanniella	4	4	1

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [110992], Station #1, Sample Date: 9/27/2011 9:15:00 AM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.		1	1
EPHEMEROPTERA			
Acentrella	5		
Apobaetis		2	
Baetidae	23		
Baetis	96	1	5
Caenis anceps	7	13	
Caenis latipennis		106	41
Callibaetis			1
Eurylophella		1	5
Heptageniidae	49	6	
Isonychia bicolor	77		4
Maccaffertium mediopunctatum	28	-99	1
Maccaffertium pulchellum	1		1
Serratella	8		
Stenonema femoratum		5	
Tricorythodes	309	30	58
HEMIPTERA			
Rhagovelia		1	
ISOPODA			
Caecidotea		1	
LIMNOPHILA			
Ancylidae		11	2
Menetus			10
Physella			11
LUMBRICINA			
Lumbricina	-99	-99	
MEGALOPTERA			
Corydalus	-99		
Sialis		-99	
MESOGASTROPODA			
Elimia	1		-99
ODONATA			
Argia		4	9
Basiaeschna janata			-99
Calopterygidae			4
Calopteryx			5
Didymops			-99
Enallagma			1
Gomphidae	5		
Hetaerina			11
Macromia		1	1
TRICHOPTERA			
Ceratopsyche morosa grp	7		

Aquid Invertebrate Database Bench Sheet Report
Mine a Breton Cr [110992], Station #1, Sample Date: 9/27/2011 9:15:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	46	1	
Chimarra		8	
Hydropsychidae	30		2
Hydroptila			1
Nectopsyche	1		
Oecetis		4	
Oxyethira			1
Triaenodes		1	14
TRICLADIDA			
Planariidae	5		1
TUBIFICIDA			
Tubificidae		7	1
VENEROIDA			
Corbicula		15	9

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [110993], Station #2, Sample Date: 9/27/2011 12:15:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
N/A	3		
"HYDRACARINA"			
Acarina	19	41	3
AMPHIPODA			
<i>Hyalella azteca</i>			59
<i>Stygobromus</i>		1	
BRANCHIOBDELLIDA			
<i>Branchiobdellida</i>	4		
COLEOPTERA			
<i>Dubiraphia</i>		3	10
<i>Ectopria nervosa</i>		5	
<i>Macronychus glabratus</i>			5
<i>Optioservus sandersoni</i>	85	7	7
<i>Psephenus herricki</i>	9	8	
<i>Stenelmis</i>	6		1
DECAPODA			
<i>Orconectes hylas</i>			1
<i>Orconectes luteus</i>		-99	
<i>Orconectes medius</i>	-99		-99
<i>Orconectes punctimanus</i>			-99
<i>Orconectes virilis</i>			-99
DIPTERA			
<i>Ablabesmyia</i>		6	
<i>Anopheles</i>			2
<i>Antocha</i>	1		
<i>Cardiocladius</i>	60		
<i>Ceratopogoninae</i>			1
<i>Chironomidae</i>	3	3	
<i>Chironomus</i>		1	
<i>Corynoneura</i>	2	1	3
<i>Cricotopus bicinctus</i>	1		
<i>Cricotopus/Orthocladius</i>	5	10	4
<i>Dicrotendipes</i>	2	39	5
<i>Eukiefferiella</i>	1		
<i>Forcipomyiinae</i>	1		
<i>Hemerodromia</i>		1	
<i>Microtendipes</i>		3	1
<i>Natarsia</i>		1	
<i>Parametriocnemus</i>	2		
<i>Paratanytarsus</i>	1	2	22
<i>Phaenopsectra</i>			2
<i>Polypedilum aviceps</i>	5		
<i>Polypedilum convictum</i>	13		

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [110993], Station #2, Sample Date: 9/27/2011 12:15:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
<i>Polypedilum illinoense</i> grp	3		8
<i>Polypedilum trigonum</i>	1		
<i>Rheocricotopus</i>			1
<i>Rheotanytarsus</i>	60	1	14
<i>Simulium</i>	43		
<i>Stempellinella</i>		2	
<i>Stenochironomus</i>	1	1	1
<i>Tabanus</i>	-99		
<i>Tanytarsus</i>	3	23	4
<i>Thienemanniella</i>	13	3	4
<i>Thienemannimyia</i> grp.	1		
<i>Tribelos</i>		5	
EPHEMEROPTERA			
<i>Acentrella</i>	10		
<i>Baetis</i>	199		8
<i>Caenis anceps</i>		3	
<i>Caenis latipennis</i>	25	936	82
<i>Eurylophella</i>	6	5	5
<i>Heptageniidae</i>	69		
<i>Isonychia bicolor</i>	192		2
<i>Leptophlebiidae</i>		1	
<i>Maccaffertium mediopunctatum</i>	23	2	
<i>Maccaffertium pulchellum</i>	20		6
<i>Procloeon</i>		1	
<i>Stenacron</i>	1		
<i>Stenonema femoratum</i>		68	
<i>Tricorythodes</i>	8	5	1
HEMIPTERA			
<i>Microvelia</i>			1
<i>Rhagovelia</i>			4
ISOPODA			
<i>Caecidotea</i>		1	3
<i>Caecidotea</i> (Blind & Unpigmented)	5	2	
LIMNOPHILA			
<i>Ancylidae</i>	1	5	3
<i>Menetus</i>			4
LUMBRICINA			
<i>Lumbricina</i>		3	
MEGALOPTERA			
<i>Corydalus</i>	2		-99
ODONATA			
<i>Argia</i>	1	6	4
<i>Basiaeschna janata</i>			-99
<i>Calopteryx</i>			8

Aquid Invertebrate Database Bench Sheet Report

Mine a Breton Cr [110993], Station #2, Sample Date: 9/27/2011 12:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Enallagma			16
Gomphidae	1	1	1
Hagenius brevistylus	1	1	
Hetaerina			4
TRICHOPTERA			
Cheumatopsyche	480		5
Chimarra	10		
Helicopsyche	1	3	
Hydropsyche	9		
Hydroptila	1		
Nectopsyche			1
Ochrotrichia	4		
Oecetis	1		2
Polycentropus			1
Triaenodes			9
TRICLADIDA			
Planariidae	15	7	3
TUBIFICIDA			
Tubificidae		1	
VENEROIDA			
Pisidiidae			1

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [110994], Station #3, Sample Date: 9/27/2011 3:30:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	7	
AMPHIPODA			
Hyalella azteca			75
COLEOPTERA			
Dubiraphia		5	48
Ectopria nervosa		1	
Helichus basalis			2
Macronychus glabratus			5
Microcylloepus pusillus			10
Optioservus sandersoni	40	2	
Psephenus herricki	21	3	1
Scirtidae			1
Stenelmis	2		2
DECAPODA			
Orconectes luteus	-99		-99
Orconectes medius		1	
Orconectes punctimanus			1
DIPTERA			
Ablabesmyia		1	1
Cardiocladius	2		
Ceratopogoninae		1	
Chironomidae	1		1
Chironomus		2	
Clinocera	1		
Corynoneura	1	3	
Cricotopus bicinctus			5
Cricotopus/Orthocladius	15	1	2
Dicrotendipes			13
Hemerodromia	3		2
Labrundinia		1	1
Parakiefferiella		1	
Parametriocnemus	2		1
Paratanytarsus			12
Paratendipes		1	
Phaenopsectra		1	5
Polypedilum aviceps	4		
Polypedilum convictum	26		
Polypedilum illinoense grp		1	1
Rheocricotopus	7		2
Rheotanytarsus	17		5
Simulium	5		1
Stempellinella		1	1
Tabanus	1		

Aquid Invertebrate Database Bench Sheet Report

Mine a Breton Cr [110994], Station #3, Sample Date: 9/27/2011 3:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tanytarsus	3	3	4
Thienemanniella	6	2	3
Thienemannimyia grp.	1		5
EPHEMEROPTERA			
Acentrella	3		
Baetis	85		3
Caenis anceps	4		
Caenis latipennis	26	207	76
Eurylophella	10	3	8
Isonychia bicolor	47		3
Leptophlebiidae		4	
Maccaffertium mediopunctatum	1		
Maccaffertium pulchellum	85	2	2
Stenacron		4	
Stenonema femoratum		3	
Tricorythodes	10		
HEMIPTERA			
Rhagovelia			1
ISOPODA			
Caecidotea	4	1	4
LIMNOPHILA			
Ancylidae	17	2	3
Physella		-99	1
LUMBRICINA			
Lumbricina	1	-99	
MEGALOPTERA			
Nigronia serricornis	4		-99
Sialis		-99	
MESOGASTROPODA			
Elimia	26		2
Hydrobiidae	15		
ODONATA			
Argia	1	-99	3
Basiaeschna janata			-99
Enallagma			12
Gomphidae	2	4	1
Hetaerina			11
Stylogomphus albistylus		-99	
PLECOPTERA			
Acroneuria	-99		
TRICHOPTERA			
Cheumatopsyche	151		14
Chimarra	4		
Helicopsyche	4		

Aquid Invertebrate Database Bench Sheet Report
Mine a Breton Cr [110994], Station #3, Sample Date: 9/27/2011 3:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Oecetis			9
Polycentropus	2		
Triaenodes		1	16
TRICLADIDA			
Planariidae	8		
TUBIFICIDA			
Tubificidae		1	
VENEROIDA			
Pisidiidae	2		

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120026], Station #1, Sample Date: 3/26/2012 11:10:00 AM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	10	
AMPHIPODA			
Hyalella azteca			3
Stygobromus		3	
COLEOPTERA			
Berosus			1
Dubiraphia	2	5	14
Ectopria nervosa	1	1	
Macronychus glabratus			6
Optioservus sandersoni	24		
Psephenus herricki	2		
Stenelmis	2	1	
DECAPODA			
Orconectes hylas	-99		
Orconectes luteus			.99
Orconectes virilis			.99
DIPTERA			
Ablabesmyia		4	6
Antocha	1		1
Atherix	1		
Cardiocladius	6		3
Ceratopogoninae		7	
Chironomidae	1	6	
Cladotanytarsus		2	
Clinocera	2		
Cricotopus bicinctus			9
Cricotopus trifascia			2
Cricotopus/Orthocladius	22	4	29
Cryptochironomus	1	3	2
Dicrotendipes	3	12	22
Diptera		1	1
Hemerodromia	11	1	2
Labrundinia			3
Micropsectra			4
Microtendipes	18	8	
Nilotanypus			4
Parakiefferiella		4	
Parametriocnemus	7		3
Paratanytarsus			10
Phaenopsectra	1	8	4
Polypedilum convictum	21		4
Polypedilum illinoense grp			20
Polypedilum scalaenum grp		1	

Aquid Invertebrate Database Bench Sheet Report

Mine a Breton Cr [120026], Station #1, Sample Date: 3/26/2012 11:10:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Pseudochironomus		2	
Rheocricotopus			1
Rheotanytarsus	25	1	69
Simulium	12		19
Stempellinella		1	1
Stenochironomus			1
Tanytarsus	18	38	52
Thienemanniella	1		6
Thienemannimyia grp.	12	3	6
Tipula	-99	-99	-99
Tribelos		1	
Tvetenia bavarica grp	6		
Tvetenia discoloripes grp	1		
EPHEMEROPTERA			
Acentrella	13		
Baetis	7		3
Caenis anceps		8	
Caenis latipennis	5	35	11
Ephemerella invaria	19		1
Ephemerella needhami	4		4
Eurylophella enoensis	1	4	6
Heptageniidae	2		
Isonychia bicolor	46		14
Maccaffertium mediopunctatum	36		3
Maccaffertium pulchellum	11		7
Serratella deficiens	6		2
Stenacron		2	
Stenonema femoratum		2	3
Tricorythodes	245	7	42
ISOPODA			
Caecidotea	1	2	2
LIMNOPHILA			
Ancylidae		4	1
Menetus		1	
Physella		1	1
LUMBRICINA			
Lumbricina	1	-99	
MEGALOPTERA			
Corydalus	-99		
MESOGASTROPODA			
Elimia			1
ODONATA			
Argia		2	2
Basiaeschna janata			-99

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120026], Station #1, Sample Date: 3/26/2012 11:10:00 AM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Boyeria			1
Calopteryx			4
Enallagma			3
Gomphidae	3	1	1
Hetaerina			7
Macromia			-99
PLECOPTERA			
Amphinemura			3
Leuctridae	3	3	1
Perlesta	2		6
Perlinella ephyre		-99	
TRICHOPTERA			
Ceratopsyche morosa grp	6		
Ceratopsyche piatrix	-99		
Cheumatopsyche	80		13
Hydroptila	4		
Mystacides		3	1
Oecetis		1	4
Oxyethira			1
Polycentropus		1	1
Pycnopsyche			1
Triaenodes			11
TRICLADIDA			
Planariidae	15	2	5
TUBIFICIDA			
Tubificidae		2	3
VENEROIDA			
Pisidiidae	2	3	

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120027], Station #2, Sample Date: 3/26/2012 1:15:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	9	14	
AMPHIPODA			
Crangonyx			3
Hyalella azteca			7
Stygobromus	3	2	
BRANCHIOBDELLIDA			
Branchiobdellida	1	2	1
COLEOPTERA			
Ancyronyx variegatus			1
Dubiraphia	2		3
Dytiscidae			1
Ectopria nervosa	1		
Optioservus sandersoni	24	1	1
Psephenus herricki	4	-99	
Stenelmis			2
DECAPODA			
Orconectes harrisonii		-99	
Orconectes luteus		-99	
Orconectes medius	1		
Orconectes virilis		-99	-99
DIPTERA			
Ablabesmyia		4	
Atherix			1
Cardiocladius	76		1
Ceratopogoninae	1	2	1
Chironomidae	3	13	
Chironomus		3	
Corynoneura		2	
Cricotopus bicinctus	2		1
Cricotopus trifascia	6		
Cricotopus/Orthocladius	173	10	11
Dasyheleinae	1		
Dicrotendipes	26	392	76
Eukiefferiella	7		1
Hemerodromia	8		
Labrundinia			1
Micropsectra	4	3	3
Orthocladius (Euorthocladius)	4		
Parakiefferiella		3	
Parametriocnemus	5		
Paratanytarsus		5	1
Paratendipes		2	3
Phaenopsectra		2	

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120027], Station #2, Sample Date: 3/26/2012 1:15:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
<i>Polypedilum aviceps</i>	3		2
<i>Polypedilum convictum</i>	3		
<i>Polypedilum illinoense</i> grp			14
<i>Rheocricotopus</i>	2		
<i>Rheotanytarsus</i>	69	3	50
<i>Simulium</i>	38		4
<i>Tabanus</i>	-99		
<i>Tanytarsus</i>	10	10	6
<i>Thienemanniella</i>	11		2
<i>Thienemannimyia</i> grp.	10	1	3
<i>Tipula</i>	-99	-99	
<i>Tribelos</i>			1
<i>Tvetenia bavarica</i> grp	8		1
<i>Tvetenia discoloripes</i> grp			1
EPHEMEROPTERA			
<i>Baetis</i>	11		1
<i>Caenis latipennis</i>	56	76	49
<i>Eurylophella bicolor</i>			3
<i>Eurylophella enoensis</i>			4
<i>Heptageniidae</i>	4		
<i>Isonychia bicolor</i>	20		1
<i>Maccaffertium mediopunctatum</i>	7		
<i>Maccaffertium pulchellum</i>	15		
<i>Stenacron</i>	1		
<i>Stenonema femoratum</i>		2	3
ISOPODA			
<i>Caecidotea</i>	1		
<i>Caecidotea</i> (Blind & Unpigmented)		2	
LEPIDOPTERA			
<i>Petrophila</i>	1		
LIMNOPHILA			
<i>Ancylidae</i>	1	3	
<i>Physella</i>		3	
LUMBRICINA			
<i>Lumbricina</i>		-99	
MEGALOPTERA			
<i>Corydalus</i>	-99		
MESOGASTROPODA			
<i>Elimia</i>			1
ODONATA			
<i>Argia</i>	5	1	
<i>Boyeria</i>			-99
<i>Calopteryx</i>			4
<i>Gomphidae</i>	1		1

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120027], Station #2, Sample Date: 3/26/2012 1:15:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
<i>Stylogomphus albistylus</i>			-99
PLECOPTERA			
<i>Leuctridae</i>	2		
<i>Perlinella drymo</i>		1	
<i>Pteronarcys pictetii</i>	1		
TRICHOPTERA			
<i>Cheumatopsyche</i>	40	1	3
<i>Chimarra</i>	1		
<i>Helicopsyche</i>	1		4
<i>Hydropsyche</i>	3		
<i>Polycentropus</i>		-99	
<i>Psychomyia</i>	1		
<i>Pycnopsyche</i>			2
<i>Triaenodes</i>			1
TRICLADIDA			
<i>Planariidae</i>	11	1	2
TUBIFICIDA			
<i>Limnodrilus hoffmeisteri</i>			1
<i>Tubificidae</i>		1	5
VENEROIDA			
<i>Pisidiidae</i>	1		4

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120028], Station #3, Sample Date: 3/26/2012 3:30:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3	4	7
AMPHIPODA			
Hyalella azteca			7
Stygobromus		2	
COLEOPTERA			
Dubiraphia		8	6
Ectopria nervosa		2	
Helichus basalis		1	
Macronychus glabratus			1
Microcylloepus pusillus			1
Optioservus sandersoni	8		
Psephenus herricki	16	5	
Stenelmis	1	2	
DECAPODA			
Orconectes luteus			-99
Orconectes medius	-99		
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		7	1
Antocha	3		
Brillia			1
Cardiocladius	36		21
Ceratopogoninae		3	1
Chironomidae	6	6	2
Chironomus		1	
Cladotanytarsus		2	
Clinocera	6		
Corynoneura		6	6
Cricotopus trifascia			2
Cricotopus/Orthocladius	78	21	25
Cryptochironomus		4	
Dicrotendipes	9	218	21
Eukiefferiella	7		2
Hemerodromia	11	5	12
Labrundinia			1
Micropsectra			3
Microtendipes		1	
Natarsia		1	
Nilotanypus	2		1
Nilothauma		1	
Parakiefferiella	1	10	1
Parametriocnemus	5		2
Paraphaenocladius		1	

Aquid Invertebrate Database Bench Sheet Report
 Mine a Breton Cr [120028], Station #3, Sample Date: 3/26/2012 3:30:00 PM
 CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Paratanytarsus		1	1
Paratendipes		4	1
Phaenopsectra			3
Polypedilum aviceps	29		7
Polypedilum convictum	25		14
Polypedilum illinoense grp			1
Prosimulium	2		3
Rheocricotopus	10		4
Rheotanytarsus	37		96
Simulium	22		10
Stempellinella		1	
Tabanus	1	-99	-99
Tanytarsus	3	10	9
Thienemanniella	4	5	5
Thienemannimyia grp.	27	5	4
Tipula	1	-99	1
Tribelos		1	
Tvetenia bavarica grp	51		18
Tvetenia discoloripes grp	7		1
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella	9		1
Baetis	5		
Caenis latipennis	29	87	15
Eurylophella	3	3	4
Isonychia bicolor	21		1
Leptophlebia			-99
Maccaffertium mediopunctatum	4		-99
Maccaffertium pulchellum	93	1	3
Stenacron	6	9	
Stenonema femoratum	6	6	1
ISOPODA			
Caecidotea	2		
Caecidotea (Blind & Unpigmented)	1	3	4
LIMNOPHILA			
Ancylidae	1	2	3
Menetus		2	1
Physella	1	2	1
LUMBRICINA			
Lumbricina		2	
MEGALOPTERA			
Nigronia serricornis	3	-99	-99
Sialis		-99	
MESOGASTROPODA			

Aquid Invertebrate Database Bench Sheet Report

Mine a Breton Cr [120028], Station #3, Sample Date: 3/26/2012 3:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Elimia	2	-99	9
ODONATA			
Argia	1	1	1
Boyeria			1
Calopteryx			-99
Enallagma			2
Gomphidae	1	1	
Hagenius brevistylus	1		
PLECOPTERA			
Amphinemura	1		
Isoperla			-99
Leuctridae	15	9	
Neoperla		-99	
Perlesta			1
TRICHOPTERA			
Cheumatopsyche	64		19
Chimarra	7		2
Helicopsyche			1
Oecetis		1	1
Polycentropus	3	2	2
Psychomyia	1		
Ptilostomis			-99
Pycnopsyche	1		-99
Rhyacophila	3		-99
Triaenodes			6
TRICLADIDA			
Planariidae	7	1	2
TUBIFICIDA			
Limnodrilus hoffmeisteri		2	
Tubificidae		12	
VENEROIDA			
Pisidiidae		1	1